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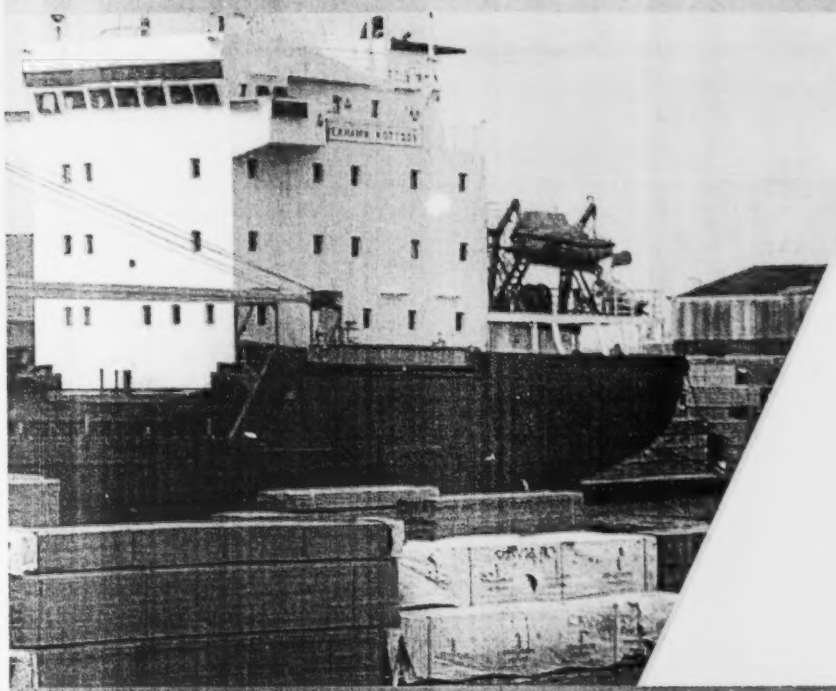

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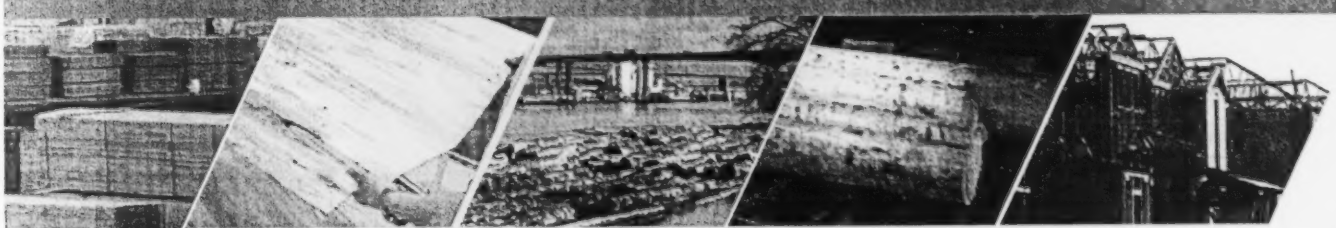
The role of tariff and non-tariff trade barriers in the global forest products trade: A Canadian perspective



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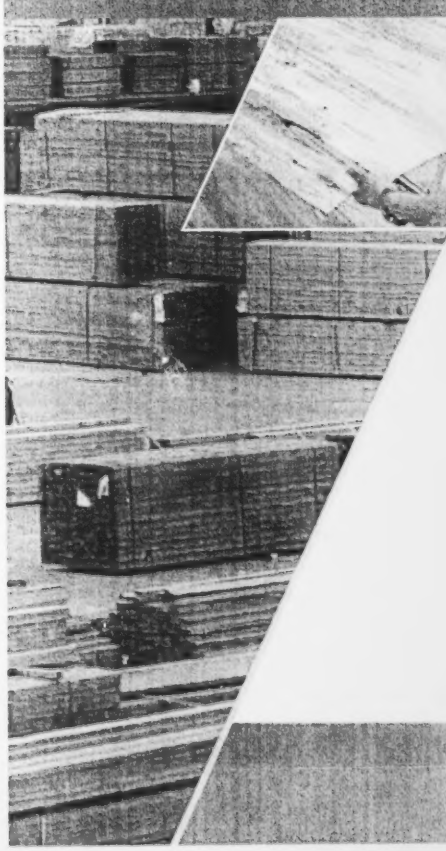

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The role of tariff and non-tariff trade barriers in the global forest products trade: A Canadian perspective

L. Sun[1], B.E.C. Bogdanski[1], B. Stennes[1], and G. Cornelis van Kooten[2]

[1] Industry, Trade, and Economics Group,
Pacific Forestry Centre,
Canadian Forest Service,
Natural Resources Canada
506 West Burnside Road
Victoria, BC, Canada V8Z 1M5

[2] Department of Economics
University of Victoria
PO Box 1700, Stn CSC
Victoria, BC, Canada V8W 2Y2

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Natural Resources Canada
Canadian Forest Service
Pacific Forestry Centre
506 West Burnside Road
Victoria, British Columbia
V8Z 1M5
Tel.: 250-363-0600
Corresponding author: L. Sun
Tel.: 250-363-8076
E-mail: lsun@nrcan.gc.ca
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Abstract

Numerous previous studies have examined the economic impacts of trade measures on forest product markets. Most have focussed on either tariffs or rather obvious quantitative measures such as import or export quota restrictions. There is growing concern about the impact of the far less obvious non-tariff trade measures on the global forest product sector. The objective of this study is to fill a gap, and to estimate trade and economic impacts of non-tariff barriers and compare them to the impacts of tariffs. A database of *ad valorem* equivalent estimates for a set of well-defined non-tariff trade restrictions is incorporated into a global forest products trade model. Non-tariff barriers are found to be less common than tariffs but are found to have similar or bigger aggregate impacts than tariffs do on trade, production, producer revenues, consumer expenditures, and value added. Impacts of reducing tariff and non-tariff barriers are often different across regions and products. Our results underscore the importance of analysing both types of trade policy and the need for continuing comprehensive trade liberalization.

Résumé

De nombreuses études ont été faites sur les répercussions économiques des mesures commerciales sur les marchés des produits forestiers. La plupart de ces études portent soit sur les tarifs, soit sur des mesures quantitatives assez évidentes telles que les restrictions imposées sous la forme de contingents d'importation ou d'exportation. On s'inquiète de plus en plus des répercussions des mesures commerciales non tarifaires moins évidentes sur le secteur mondial des produits forestiers. Le but de cette étude est de faire une estimation des répercussions commerciales et économiques des obstacles non tarifaires et de les comparer aux répercussions des tarifs. Une base de données d'équivalents ad-valorem estimatifs pour une série de restrictions commerciales non tarifaires bien définies est intégrée dans un modèle commercial mondial des produits forestiers. On constate que les obstacles non tarifaires sont moins fréquents que les obstacles tarifaires mais qu'ils ont des répercussions cumulatives semblables, sinon plus importantes, sur le commerce, la production, les recettes des producteurs, les dépenses des consommateurs et la valeur ajoutée. Les répercussions de la réduction des tarifs et des obstacles non tarifaires varient souvent d'une région à l'autre et d'un produit à l'autre. Les résultats soulignent l'importance de l'analyse des deux types de politique commerciale et du besoin de continuer de libérer globalement le commerce.

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Key Points

- Non-tariff trade barriers (NTBs) include such things as quantitative restrictions, price control measures, administrative restrictions, assistant domestic policies, regulations and standards, certification, and product labelling.
- The most common factors that seem to trigger trade barriers include political motivation, economic conditions, and retaliation to other trade disputes. It is essential for countries to predict where trade barriers are most likely to occur in order to develop proactive strategies to deter or mitigate them.
- *Ad valorem* equivalent estimates (AVEs) for a set of well-defined non-tariff trade barriers and tariffs in the forest industry are presented for major countries. At the global and regional level, and in most countries, AVEs of NTBs are generally higher than tariffs. Countries with NTB AVE values above world average are Malaysia, Nigeria, USA, China, South Africa, Chile, and the Russian Federation. Countries such as Nigeria, the Russian Federation, Mexico, Brazil, Argentina, Malaysia, Chile, and China have instituted tariffs in excess of world averages.
- The Global Forest Product Model (GFPM) developed by Buongiorno and others (Buongiorno et al. 2003; Turner et al. 2006) is used to estimate the economic impacts of non-tariff trade barriers and tariffs in the forest industry. Results show relatively small global impacts, but significant impacts to some countries. Global welfare increases with the removal of NTBs or tariffs. Among the 25 major countries listed, 19 experience net producer/consumer gains from free trading. Japan, Germany, and Canada obtain the largest net gains of $US 2.4 billion, $US 1.6 billion, and $US 1.3 billion, respectively.
- In Canada, the removal of NTBs and tariffs have different impacts. The removal of NTBs results in an increase in roundwood imports and displacement of domestic roundwood in the further manufacture of forest products. Tariff reduction, conversely, results in roundwood production increases of greater than 1 million m^3, with this increase processed domestically.
- Elimination of either NTBs or tariffs results in increased net exports of Canadian forest products.

1. Introduction

Global consumption and trade in forest products have expanded over the past few decades, and trade growth in particular has occurred in a period of global trade liberalization (FAO 2005; WTO 2009). For small, open economies and developing countries with relatively large forest resources, open trade provides opportunity to generate wealth and to develop and diversify the economy. In this regard, multilateral and bilateral processes that further open global trade by reducing all forms of unwarranted trade restrictions are important for many forestry-practicing countries (Rytkönen 2003).

Multilateral trade negotiations under the General Agreement on Tariffs and Trade (GATT) process have resulted in significant reductions in tariff rates on forest products since the end of World War II. In particular, the Uruguay Round of negotiations (1986–1994) reduced the average tariff on wood-based panels by 30%, on semi-manufactures by 50%, and on wood articles by 67%, whereas tariffs on pulp and paper products were essentially phased out (Barbier 1995; Rytkönen 2003). Although commitments to reduce tariffs have not always been fully realized, tariff levels on forest products have been reduced to very low levels in developed countries and significantly reduced in developing countries (WTO 2001).

The Uruguay Round also focused on the reduction of non-tariff trade barriers (NTB; WTO 2001). NTBs include such things as import and export quotas, and opaque measures such as licensing requirements. Specific Uruguay Round agreements that support the reduction of NTBs include the agreements on Safeguards, Import Licensing Procedures, Technical Barriers of Trade, and Application of Sanitary and Phytosanitary Measures. These agreements recognize the right and economic rationale to regulate trade and support specific industries in order to address market failures (WTO 2001). The agreements also recognize that market failure potentially could be used as a pretext to restrict trade. Since the implementation of these agreements, NTBs have been reduced, including some in the forest products sector (WTO 2001). However, as international agreements have significantly reduced tariffs in many sectors, the relative importance of NTBs has increased (Rytkönen 2003), and there is growing interest in better quantifying and reducing the impacts of NTBs (Deardorff and Stern 1997; Ferrantino 2006).

The benefits of reduced NTBs are difficult to measure (Dean et al. 2006; Ferrantino 2006; Kee et al. 2008; WTO 2001), but methods exist to estimate NTBs and the benefits of facilitating trade by reducing non-policy factors that can affect trade (Anderson and van Wincoop 2004; Baga̍ and Wilson 2006; Benghin and Bureau 2001). For example, Andriamananjara et al. (2004) estimate the potential trade gains from eliminating non-tariff barriers across 14 sectors and 18 regions at $US 90 billion. This estimate does not cover all traded goods or all forms of non-tariff measures (it did include technical standards, and phytosanitary and investment measures) and ignores services, so the potential benefit may be much higher. About $5.5 billion of the $US 90 billion gain, or 6.1%, is attributable to trade liberalization in tissue and toilet paper products and in paper used in newspapers, magazines, and paperback books. No other forest-related products were captured in this analysis and there was no breakdown between sanitary products and print products.

Previous research on NTBs in the forest product sector have either been descriptive (Bourke and Leitch 2000; Cohen et al. 2003; New Zealand Forest Research 1999) or have focussed on a small set of products and countries (Li et al. 2007; New Zealand Forest Research 1999; Prestemon et al. 2006; Turner et al. 2008a; Vincent 1992). There has been no attempt, to date, to comprehensively estimate the impacts of reducing NTBs on the global forest products sector and compare them to the impacts of reducing tariffs. This is the objective of this analysis.

This study quantifies the impacts of existing NTBs on the forest products sector and compares them to the impacts of existing tariffs. We find that, although NTBs are not as common as tariffs, their impact is at least as great as that of tariffs. Conversely, even though NTBs generally have larger aggregate impacts than tariffs do, the impacts of tariffs on some forest product groups are significant and occasionally have different directional impacts than NTBs.

The remainder of this report is organized as follows. First, non-tariff measures are defined. It is followed by a summary of factors triggering trade protection. The next section introduces the approaches used to measure NTBs so they can be used in simulation models. This is followed by a description of the method for estimating the impacts of non-tariff and tariff barriers. Then the results are presented and analyzed. We conclude with a brief discussion of some of the implications of our findings.

2. Defining non-tariff measures

There are numerous types of NTBs associated with the trade of forest products. We categorize non-tariff measures into six broad groups:

Quantitative restrictions are some of the most common, and include constraints such as import quotas, export bans, and tariff quotas. Examples include the EU import quota on board and panel products (Bourke and Leitch 2000), the 1996 Canada–U.S. Softwood Lumber Agreement (SLA) and the 2006 Softwood Lumber Agreement (Option B). Many countries, including the U.S., Canada, New Zealand, Malaysia, the Philippines, Indonesia, Vietnam, and Mexico, restrict raw log exports to some extent (Rytkönen 2003). The cost of export restrictions is significant (New Zealand Forest Research 1999; Rytkönen 2003; Vincent 1992).

Administrative restrictions, such as complex import licensing procedures, customs procedures, and financial transactions, are another form of NTB. Bourke and Leitch (2000) found that wood product exports to India and China are subject to complex import licensing requirements.

Phytosanitary and technical regulations and standards can be used as NTBs, and include restrictions on timber preservation processes and materials, controls on processing methods, packaging regulations, and building codes and standards. Turner et al. (2008a) found building certification and standards imposed by Japan on prefabricated buildings to be a significant cost to the New Zealand forest products industry.

Price control measures are another form of NTB, and include customs surcharges, import taxes, licence fees, mandated minimum/maximum price limits for imports, prior deposits, and anti-dumping and countervailing duties.

Assistant domestic policies include producer or exporter subsidies, financial assistance, tax concessions, or export-encouragement schemes. They can substantially improve the competitiveness of domestic producers in international markets. New Zealand Forest Research (1999) found afforestation subsidies, raw material subsidies, transportation subsidies, energy subsidies, and stumpage subsidies present in the global forest sector.

Forest management certification and product labelling are also used as a non-tariff barrier (Rytkönen 2003). These measures are becoming more common and are currently an important and controversial issue. Some jurisdictions, especially Japan and the EU, consider voluntary, market-based and transparent environmental certification and labelling schemes to be efficient economic instruments to encourage consumers to favour environmental friendly products and do not consider these measures to be NTBs (Rice et al. 2000). However, other jurisdictions, particularly net exporting countries, recognize certification and labelling as potential trade barriers. There is no official WTO position on this issue.

3. Factors leading to trade protection

A variety of theoretical and empirical studies have focused on the determinants of a nation's trade barriers, both tariffs and NTBs. The implicit assumption behind these studies is that there are common economic and political factors that can explain the implementation and structure of protection across countries and industries. We summarized these factors into three categories.

Political motivation: One significant body of research on political-economy models (Stigler 1971; Peltzman 1976; Caves 1976; Brock and Magee 1978; Hillman 1982; Marvel and Ray 1983,1987; Ray 1981a, b; Gawande and Bandyopadhyay 2000; Ederington and Minier 2003) identifies the political motivations behind the trade barriers. The models claim trade barriers are the result of rent-seeking actions of self-interested industry groups and politicians. Rather than considering trade policy as a tool used by government to maximize social welfare, as in traditional economic theory (Gawande et al. 2006), trade policy in political-economy models is endogenously determined by interactions between self-interested regulators and organized special-interest groups. Industries form a lobby with the intention of maximizing rents from protection, net of lobbying expenditures, whereas politicians who formulate trade policy seek income from lobbying in order to finance campaign spending.

According to the political-economy model, distinctions exist between consumers and producers, or between different groups of consumers and producers. In the trade policy case, the benefits from free trade are diffuse and the winners do not always know in advance who they are, whereas the benefits of trade protection typically accrue to a well-defined group that knows precisely how much it stands to lose if left unprotected. This asymmetry means that protection may be politically efficient even if it is inefficient in an economic sense (Lee and Swagel 1997).

The political-economy model also predicts a trend towards increased use of NTBs. Kono (2006) argues political leaders support tariff reductions that favour consumers, which are transparent to voters, and support the use of complex, opaque NTBs to support domestic industry, thereby maintaining political support from both consumers and producers.

Economic conditions: Cohen et al. (2003) point out that factors leading to oversupply situations, such as economic recession, improved productivity from innovation, and increased competition from imports, may contribute to the implementation of trade barriers, in the form of both tariffs and non-tariffs. In their analysis of the solid wood products sectors, they argue that an oversupply of solid wood products resulting from technological adaptations has triggered increased protectionist measures in both the U.S. and Europe. The softwood lumber sectors in these regions have moved towards the use of NTBs, including phytosanitary measures by the EU and tariffs and quotas in the U.S. Supporting this view, Sing (1987) found developing countries encountered greater difficulty penetrating developed country markets during economic recessions.

Trade retaliation: Gawande (1995) and Baldwin (1990) share the view that a nation's NTBs have both a political component from industry lobbying and a retaliatory component that serves as a strategic deterrent against undesirable protectionist policies of its trading partners. Using 1983 bilateral U.S. NTBs data, Gawande (1995) finds a significant retaliatory component against a group of trading partners: "U.S. NTBs are observed to respond offensively to NTBs imposed by European countries on U.S. exports of processed foods and capital-intensive goods, and to Japanese NTBs on U.S. exports of general manufactures. The news is that trade laws in the U.S. already implicitly permit retaliation, a trend that is likely to intensify with the new Super 301 and Special 301 provisions in the *U.S. Trade Act* that permit greater unilateral action by the U.S."

4. Measuring non-tariff barriers

Quantifying the prevalence of NTBs is important for international and inter-sector comparisons. It can also provide input for trade and economic impact analysis, which is important for policy makers to assess potential economic gain from the elimination of NTBs. The main analytical methods consist of an inventory or a survey, followed by analysis of prices and quantities to convert them to equivalent tariffs.

4.1 Inventories and surveys

The first and basic step for analysis of NTBs is to develop an inventory of NTBs, of which several have been compiled. These include the general inventories of the UN Conference on Trade and Development's (UNCTAD) Trade Analysis and Information System (TRAINS) and of Donnelly and Manifold (2005), and a forest-sector inventory by New Zealand Forest Research (1999). NTB inventories are typically compiled from government-supplied information as part of meeting WTO membership requirements, or by surveying exporters. NTB inventories are typically textual descriptions. TRAINS is the only inventory that has an accompanying electronic database for a large number of countries (more than 150), and its simple statistics, such as frequency ratios (numbers of product categories subject to NTBs as a proportion of the total number of product categories) and import coverage ratios (values of imports of each commodity subject to NTBs as a proportion of imports in the corresponding product category) can be obtained to identify the level of NTBs for specific industries and countries. Such measures can be unweighted or weighted by imports or by production. The key limitation of this approach is that it captures the frequency of the NTBs and not the degree to which these restrict trade. For example, one sector may have many products subject to minor NTBs, whereas another sector may have fewer products but very restrictive NTBs. The frequency and import coverage ratios predict much higher NTBs for the first sector, even though the latter sector may have more non-tariff trade restrictions. Further discussion of NTB inventories is provided by Ferrantino (2006).

4.2 Price-based approaches

Price-based approaches provide measures of NTBs expressed as tariff equivalences. The idea of the price-based method is that NTBs on an imported good raise the domestic price of the traded good above a reference level, creating a price gap. The reference price may be the imported price or domestic price without the NTBs. The domestic price in the absence of the NTBs is usually not observable and must be adjusted for other complex factors influencing prices. The wedge between the price of the imported good and the price of the domestic equivalent typically is used to measure the NTBs. By assuming that the imported good and the domestic product are comparable or homogeneous, the price gap is attributed to trade impediments from various NTBs once border tariffs, insurance, and transportation costs are considered.

This price-wedge approach tends to be used in a single importing country for a few products of interest, as it has heavy data requirements. Precise information on prices, transport and handling costs, tariffs, taxes, and subsidies are required; it is difficult to obtain this information for multiple countries and products. Even when the data are available, comparisons between a commodity's domestic and international prices can be biased by cross-country differences in supply and demand elasticity.

Price-based econometric approaches are used to examine NTBs for multiple products across countries. They identify systematic reasons for price differences between countries in order to uncover the potential extent of NTB effects. However, this approach can make comparisons only across industries and countries; it is very limited for product-specific and country-specific estimates.

One appealing advantage of the price-based approach is that the estimates of tariff equivalent can be used as an input in partial or general equilibrium to analyze economic effects of NTBs.

4.3 *Quantity-based approaches*

With the quantity-based method, it is the quantity reduction due to NTBs that is used to measure the effective protection provided by a non-tariff barrier. However, usually only the actual quantity imported under the NTB is observable. A quantity-based econometric model is then typically used to measure the quantity effects of NTBs with cross-commodity cross-country data to explain trade flows. One approach is the gravity model, in which the residuals from the economic regressions of trade flows on the various determinants of trade represent NTBs; another model uses dummy variables to capture the quantity effect of NTBs.

An adequate model of the determinants of trade is required, as are data covering a sufficient variety of trading situations. Unlike the price-based method, results must be translated to tariff equivalents using estimates of import demand elasticities. The advantage of this approach is that, compared to price data, quantity data are more abundant and harmonized across countries. Furthermore, this approach is able to capture the aggregate impact of all barriers combined. The downside of this approach is that it introduces more uncertainty regarding the precision of *ad valorem* equivalent estimates due to the two-step process: converting the estimated quantity gap to a price gap using an estimated elasticity measure. Kee et al. (2008) address the issue by using common information to estimate both the import demand elasticity and the quantity gaps. Having information on the *ad valorem* equivalent tariff of non-tariff measures allows for simulation of the impacts of NTBs on such things as trade, production, and prices.

5. Assessing the economic effects of non-tariff trade barriers on the forest products sector

5.1 The Global Forest Products Model (GFPM)

Once the tariff equivalence of NTBs is measured, applied general equilibrium (AGE) or partial equilibrium models can be used with information on tariffs and tariff-equivalent NTBs to assess their economic effects on trade, production, and prices. AGE models take into account interactions between industries and countries, and provide the most comprehensive framework for quantitative assessments of the economic effects of changes. However, these models require a substantial amount of sectoral data and information on the workings of the economy. As our analysis focusses on one sector of the economy, a partial equilibrium model is employed.

We are not aware of any previous attempts to assess the economic impacts of non-tariff trade barriers in the forest products sector and to compare them to existing tariffs. In this section, we introduce the simulation model and tariff and non-tariff data used to assess the economic impacts of NTBs in the forest sector and compare them to tariff impacts. We incorporate information on NTBs and tariffs into a partial equilibrium forest products model, namely, the Global Forest Products Model (GFPM), developed by Buongiorno and others (Buongiorno et al.,2003; Turner et al. 2006).

The GFPM is a spatial equilibrium trade model (Samuelson 1952; Takayama and Judge 1971). The model simulates the international wood products sector, and covers 18 forest products in 180 countries. It is a dynamic spatial equilibrium model that projects production, imports, exports, and prices by recognizing the interrelated markets among countries and several products through manufacturing, trade, and utilization. The GFPM has been used to predict the global and regional effects of several (potential) policy changes, including the Russian export tax (Turner et al. 2008b), phytosanitary measures (Li et al. 2007), invasive pest and forest biosecurity policies (Prestemon et al. 2006), uncontrolled illegal logging (Seneca Creek 2004; Li et al. 2008), accelerated tariff liberalization (Zhu et al. 2001), and trade agreements (Turner and Buongiorno 2001).

A detailed mathematical specification of the GFPM is provided in Zhu et al. (2007). The objective of the model is to maximize the sum of producer and consumer surplus minus manufacturing and transportation costs. Maximization of the surplus is subject to constraints related to material balance, trade inertia, and manufacturing capacity.

The basic mathematical structure of the model is as follows:

$$Max \sum_i \sum_k \int_0^{D_{ik}} P_{ik}(D_{ik}) dD_{ik} - \sum_i \sum_k \int_0^{S_{ik}} P_{ik}(S_{ik}) dS_{ik} - \sum_i \sum_k Y_{ik} m_{ik} - \sum_i \sum_j \sum_k c_{ijk} T_{ijk}$$

Subject to:

$$\sum_j T_{ijk} + S_{ik} + Y_{ik} - D_{ik} - \sum_n a_{ikn} Y_{in} - \sum_j T_{ijk} = 0$$

$$T^L_{ijk} \le T_{ijk} \le T^u_{ijk}$$

$$Y_{ik} \le K_{ik}$$

In this formulation, i and j refer to exporting and importing countries, respectively; k to the specific commodity; P is price (in U.S. dollars); D is final product demand; S is raw material supply; Y is the quantity manufactured; m is manufacturing cost; c is the transportation cost plus import tariff; T is the quantity transported; a_{ikn} refers to input in exporting country i of commodity k per unit of n; T^u_{ijk} and T^L_{ijk} refer to the respective upper and lower bounds on imports and exports of commodity k; and K_{ik} refers to the current capacity of exporting country i to produce k.

5.2 Data information

Data on tariffs and NTBs incorporated into the GFPM are taken from a database produced by Kee et al. (2008; the database can be downloaded at http://go.worldbank.org/C5VQJIVeH0). They derived *ad valorem* equivalents (AVEs) of NTBs using the TRAINS dataset and a quantity-based econometric model by first identifying quantity impacts and then inferring price impacts using import demand elasticities. This database contains AVE estimates for a set of well-defined NTBs, also known as core NTBs, and existing tariff rates for many products at the Harmonised System (HS) six-digit level that include forest products. The NTBs covered in Kee et al. (2008) are price control measures (TRAINS codes 3100, 3200, and 3300), quantity control measures (TRAINS codes 6100, 6200, and 6300), monopolistic measures (TRAINS code 7000), and technical regulations (TRAINS code 8100). Measures such as subsidies, anti-dumping/countervail measures, voluntary export restrictions, and general NTBs are not captured in this analysis; their effects are thus not reflected in the estimated AVEs.

To measure the impact of NTBs and tariffs, a base-case scenario is produced by adding NTB AVE values and tariff values for all wood, pulp, and paper and paperboard products into the input files of the GFPM. Before adding AVE and tariff values produced by Kee et al. (2008) for products at the HS six-digit level commodity classification, the values are translated into four-digit HS level product classes to conform to the GFPM by taking import-weighted averages (see Table 1 for the four-digit classifications).

The value and frequency of both AVEs for NTBs and tariffs are summarized by geographic region and forest product group in Tables 2 and 3, respectively. In total, 95 countries are included in the database, and 25 major countries are listed in the tables. After converting the values from the HS six-digit level to the HS four-digit level, there are 655 instances of countries applying a tariff (442), a NTB (42), or both (171) on forest products. AVEs for NTBs are larger than tariffs on average at the world and regional levels, and in most of the countries (Table 2). Countries with NTB AVE values above the world average are Malaysia (0.31), Nigeria (0.26), the U.S. (0.23), China (0.22), South Africa (0.2), Chile, (0.13), and the Russian Federation (0.13). Countries that have tariffs above the world average include Nigeria (0.18), the Russian Federation (0.14), Mexico (0.12), Brazil (0.08), Argentina (0.08), Malaysia (0.08), Chile (0.07), and China (0.07). From Table 3, tariffs are generally higher for more processed products and lower for primary forest products (logs and pulp); there is no such consistency with NTBs, although the highest values occur with panel products.

Table 1. Forest products and associated Harmonized System codes included in the Global Forest Products Model

Fuel wood	HS 4401
Chips and particles	HS 4402
Industrial roundwood	HS 4403
Other industrial roundwood	HS 4404, 4405, 4406
Sawnwood	HS 4407
Plywood	HS 4412
Veneer sheets	HS 4408
Particleboard	HS 4410
Fiberboard	HS 4411
Mechanic pulp	HS 4701
Chemical pulp	HS 4702, 4703, 4704
Semi-chemical pulp:	HS 4705
Other fibre pulp	HS 4706, 4707
Newsprint	HS 4801
Printing and writing paper	HS 4802

Table 2. Trade protection across countries

	Non-tariff	Tariff	Total
Africa	**0.29**	**0.10**	**0.28**
Egypt	-	-	-
Nigeria	0.26	0.18	0.44
South Africa	0.20	0.04	0.25
North/Central America	**0.13**	**0.04**	**0.11**
Canada	0.09	0.00	0.09
Mexico	0.06	0.12	0.18
United States	0.23	0.00	0.23
South America	**0.15**	**0.08**	**0.24**
Argentina	0.03	0.08	0.11
Brazil	0.02	0.08	0.10
Chile	0.13	0.07	0.20
Asia	**0.13**	**0.07**	**0.15**
China	0.22	0.07	0.29
Indonesia	0.01	0.03	0.04
Japan	0.01	0.01	0.02
Korea, Republic of	-	-	-
Malaysia	0.31	0.08	0.38
Oceania	**0.08**	**0.06**	**0.11**
Australia	0.00	0.03	0.03
New Zealand	0.06	0.01	0.08
Europe	**0.07**	**0.03**	**0.04**
Austria	0.00	0.01	0.01
Finland	0.00	0.01	0.01
France	0.00	0.01	0.01
Germany	0.00	0.01	0.01
Italy	0.00	0.01	0.01
Russian Federation	0.13	0.14	0.26
Spain	-	-	-
Sweden	0.00	0.01	0.01
United Kingdom	0.00	0.01	0.01
World	0.09	0.05	0.13

Table 3. Frequency and trade protection across groups of forest products.

	Tariff and non-tariff trade barrier			Tariff only		Non-tariff barrier only		Free trade
	Number of countries	Average NTB (AVE)	Average tariff	Number of countries	Average tariff	Number of countries	Average NTB (AVE)	Number of countries
Fuelwood	17	13%	9%	17	6%	6	4%	53
Industrial logs	17	31%	9%	28	7%	11	13%	36
Sawnwood	21	11%	12%	44	4%	6	2%	21
Wood panels	24	19%	14%	61	10%	2	0%	6
Particleboard	14	83%	16%	51	9%	1	2%	27
Fibreboard	19	39%	17%	59	9%	1	0%	14
Chemical pulp	10	50%	8%	25	4%	10	9%	48
Other pulp	14	23%	9%	25	5%	5	3%	49
Printing and writing paper	16	12%	14%	64	7%	0	n/a	13
Other paper/paperboard	19	22%	14%	68	7%	0	n/a	6

6. Simulation results

Using the data adapted from Kee et al. (2008), the GFPM produces estimates of production, exports, imports, and prices for 2006 and for the projection period 2007–2015. First, a base-case scenario is produced that includes tariffs and NTBs. This base-case scenario is compared to the cases of (1) no NTBs, (2) no tariffs, and (3) no NTBs plus no tariffs. In each case, this is done by removing the values of the NTBs, tariffs, or both from the base data file. The difference between the base-case scenario and an alternative scenario is an estimate of the impact of the trade barrier. For example, if both NTBs and tariffs are removed, global roundwood production would increase by 10.7 million m^3, and global trade would increase by 25.3 million m^3 (Table 4).

The impacts on production, exports, imports, and net trade on industrial roundwood, sawnwood, wood-based panels, particleboard, fibreboard, chemical pulp, printing and writing paper, and other paper and paperboard for major regions and countries are summarized in Tables 4 through 11. Impacts on producer revenue, consumer expenditures, and value added are summarized in Table 12. All results represent the average change over the 2007–2015 period of study. The impacts on each economic measure are discussed in turn, with some focus on Canada.

Table 4. Predicted effects of changes in trade policies on industrial roundwood (× 1000 m³)

	Non-tariff			Tariff			Total		
	Prod'n	Import	Export	Prod'n	Import	Export	Prod'n	Import	Export
Africa	**235**	**248**	**1,694**	**-821**	**180**	**30**	**250**	**342**	2,094
Egypt	1	-1	0	-3	1	0	-2	0	0
Nigeria	-127	0	0	-27	0	0	-133	0	1
South Africa	411	13	1,048	-240	0	30	534	13	1,443
North/Central America	**-7,702**	**4,674**	**6,980**	**335**	**29**	**7**	**-4,590**	**4,683**	**6,963**
Canada	-360	2,850	21	1,194	0	0	1,990	2,850	1
Mexico	-1,774	41	0	-2,444	23	0	-3,013	41	0
United States	-5,582	1,776	6,933	1,660	0	0	-3,489	1,776	6,928
South America	**3,129**	**7**	**1,808**	**2,208**	**7**	**-1**	**4,457**	**14**	**1,541**
Argentina	21	0	1	150	5	0	384	4	1
Brazil	1,915	5	1,149	1,495	0	0	2,423	5	1,150
Chile	1,241	0	610	692	1	-1	1,659	1	347
Asia	**-11,270**	**29,758**	**1,200**	**-88**	**-637**	**427**	**-14,783**	**30,416**	**1,467**
China	-10,210	17,144	0	-1,679	0	0	-11,474	17,139	0
Indonesia	1,258	0	10	2,152	0	-1	2,622	0	3
Japan	-4,863	12,904	5	-16	-1,155	0	-6,744	12,659	5
Korea, Republic of	169	-12	0	150	4	0	277	3	0
Malaysia	961	64	13	1,144	0	-1	1,581	64	4
Oceania	**2,282**	**0**	**3,159**	**-18**	**8**	**1,172**	**2,583**	**9**	**4,237**
Australia	1,197	0	1,549	-2	0	1,189	1,360	0	2,620
New Zealand	790	1	1,267	-1	0	-18	908	1	1,257
Europe	**20,494**	**-10,959**	**8,887**	**1,878**	**2,216**	**167**	**22,816**	**-10,119**	**9,043**
EU-25	16,256	-12,996	4,893	1,809	1,925	-662	18,590	-12,574	4,445
Austria	686	-1	0	370	1	0	996	-1	0
Finland	3,122	-6,101	0	832	78	0	3,665	-5,417	0
France	636	0	404	3	0	-1,066	837	0	-71
Germany	3,228	0	5	1,762	0	-2	4,712	0	0
Italy	182	-351	0	60	2,051	0	255	-259	0
Russian Federation	2,131	0	2,712	-28	259	528	2,030	259	2,710
Spain	1,006	-1,072	0	-1,167	-680	0	-412	-1,577	0
Sweden	2,966	-4,923	0	1,036	3	0	3,825	-4,875	0
United Kingdom	258	-9	0	137	319	0	372	1	0
Developed, all	12,110	6,577	19,717	4,379	1,168	1,369	17,292	7,283	21,303
Developing, all	-4,942	17,151	4,011	-885	635	434	-6,558	18,063	4,043
World	7,169	23,728	23,729	3,493	1,803	1,803	10,734	25,345	25,345

Table 5. Predicted effects of changes in trade policies on sawnwood (× 1000 m^3)

	Non-tariff			Tariff			Total		
	Prod'n	Import	Export	Prod'n	Import	Export	Prod'n	Import	Export
Africa	**-319**	**542**	**32**	**-158**	**457**	**-1**	**-406**	**821**	**20**
Egypt	0	-4	0	0	96	0	0	92	0
Nigeria	5	0	0	1	0	0	6	0	0
South Africa	-195	185	0	5	0	0	-199	186	0
North/Central America	**567**	**810**	**1,572**	**-617**	**838**	**174**	**565**	**831**	**1,590**
Canada	621	902	1,571	145	0	171	613	902	1,585
Mexico	-1,205	1,327	0	-1,155	1,327	0	-1,546	1,764	0
United States	1,137	-1,404	0	425	-567	0	1,524	-1,909	0
South America	**115**	**0**	**166**	**-174**	**86**	**-55**	**174**	**87**	**333**
Argentina	0	0	0	-17	16	0	-18	16	2
Brazil	-32	0	1	-62	38	0	-55	38	25
Chile	114	0	133	-80	7	-62	231	7	263
Asia	**1,020**	**739**	**1,053**	**56**	**482**	**135**	**1,163**	**1,491**	**1,380**
China	-1,170	1,852	0	319	-243	0	-1,100	1,852	0
Indonesia	251	0	258	-15	0	-4	263	0	277
Japan	1,628	-1,558	0	93	-114	0	1,845	-1,657	1
Korea, Republic of	10	-22	0	-29	19	0	-38	19	0
Malaysia	357	449	813	-2	0	6	537	449	997
Oceania	**-41**	**10**	**-6**	**-5**	**22**	**2**	**-54**	**35**	**-5**
Australia	-16	1	0	-1	1	0	-19	1	0
New Zealand	-21	10	-3	1	0	1	-25	13	-3
Europe	**-1,005**	**648**	**-66**	**1,593**	**-239**	**1,391**	**-382**	**2,110**	**2,058**
EU-25	-1,548	940	-368	1,156	-521	659	-1,679	2,135	727
Austria	426	0	437	-162	0	-156	410	0	426
Finland	-724	0	-712	62	0	69	-527	0	-509
France	-239	215	0	205	-218	0	-267	231	0
Germany	575	0	617	230	0	253	543	0	604
Italy	13	-31	0	1,721	-1,730	0	204	-230	0
Russian Federation	350	0	375	339	5	357	680	5	720
Spain	-201	182	0	-1,480	1,510	0	-1,543	1,557	0
Sweden	-461	0	-447	53	0	61	-381	0	-361
United Kingdom	231	-253	0	341	-353	0	290	-322	0
Developed, all	2,155	-1,226	1,502	2,259	-831	1,566	3,355	-268	3,645
Developing, all	-1,818	3,976	1,247	-1,563	2,476	79	-2,294	5,643	1,731
World	338	2,750	2,750	696	1,645	1,645	1,060	5,375	5,375

Table 6. Predicted effects of changes in trade policies on wood-based panels (× 1000 m^3)

	Non-tariff			Tariff			Total		
	Prod'n	Import	Export	Prod'n	Import	Export	Prod'n	Import	Export
Africa	**4**	**9**	**-2**	**60**	**21**	**70**	**74**	**21**	**75**
Egypt	0	0	0	0	1	0	0	1	0
Nigeria	0	0	0	0	0	0	0	0	0
South Africa	-1	0	0	0	0	0	-1	0	0
North/Central America	**-1,340**	**3,365**	**780**	**-74**	**363**	**168**	**-1,375**	**3,536**	**881**
Canada	73	0	75	68	97	167	75	98	175
Mexico	-38	74	0	-40	85	0	-46	102	0
United States	-1,375	3,291	704	-94	169	0	-1,396	3,324	705
South America	**24**	**15**	**43**	**585**	**15**	**606**	**526**	**24**	**559**
Argentina	-1	2	0	-3	3	0	-3	3	0
Brazil	90	0	93	509	6	522	443	6	456
Chile	-57	6	-50	72	0	73	86	6	93
Asia	**3,576**	**105**	**2,940**	**170**	**1,619**	**1,478**	**3,557**	**1,441**	**3,923**
China	2,202	932	2,393	-566	685	0	2,400	932	2,499
Indonesia	375	0	378	1,054	12	1,073	1,001	12	1,020
Japan	916	-909	0	-610	770	5	-11	222	6
Korea, Republic of	34	-39	0	-45	41	0	-49	41	0
Malaysia	125	51	177	378	6	386	329	51	382
Oceania	**-58**	**45**	**-11**	**-110**	**114**	**1**	**-127**	**121**	**-5**
Australia	-37	36	0	-110	110	0	-111	110	0
New Zealand	-12	8	-2	-1	1	1	-12	8	-2
Europe	**-229**	**19**	**-194**	**-163**	**605**	**414**	**-276**	**643**	**354**
EU-25	-156	7	-135	-136	499	336	-232	538	291
Austria	-63	0	-63	15	12	27	-39	28	-11
Finland	-2	0	-2	0	0	0	-10	8	-1
France	-2	0	0	0	0	0	-2	0	0
Germany	1	-3	0	-27	84	50	-30	88	50
Italy	-2	0	0	-1	0	0	-3	0	0
Russian Federation	-2	0	0	-19	20	1	-22	20	-1
Spain	-11	10	0	-143	144	0	-143	144	0
Sweden	-1	0	0	-1	5	4	-1	5	4
United Kingdom	0	-1	0	0	21	15	0	21	15
Developed, all	**-662**	**2,441**	**584**	**-922**	**1,772**	**586**	**-1,745**	**4,427**	**1,238**
Developing, all	**2,638**	**1,115**	**2,973**	**1,390**	**964**	**2,150**	**4,124**	**1,360**	**4,548**
World	**1,976**	**3,557**	**3,556**	**469**	**2,736**	**2,736**	**2,378**	**5,787**	**5,786**

Table 7. Predicted effects of changes in trade policies on particleboard (× 1000 m³)

	Non-tariff			Tariff			Total		
	Prod'n	Import	Export	Prod'n	Import	Export	Prod'n	Import	Export
Africa	**-73**	**73**	**1**	**-49**	**58**	**2**	**-94**	**101**	**6**
Egypt	0	0	0	-1	1	0	-1	1	0
Nigeria	-1	1	0	-1	1	0	-1	1	0
South Africa	-3	0	0	1	1	0	-5	1	0
North/Central America	**-5,830**	**7,017**	**505**	**23**	**95**	**118**	**-4,780**	**7,182**	**1,766**
Canada	351	0	361	96	0	102	1,426	0	1,472
Mexico	62	-61	0	-71	88	9	-70	88	9
United States	-6,234	7,060	134	-5	0	0	-6,126	7,068	270
South America	**19**	**45**	**54**	**-2**	**13**	**10**	**177**	**57**	**224**
Argentina	3	0	3	-5	5	0	97	5	103
Brazil	0	0	0	-1	1	0	-2	1	0
Chile	38	10	49	9	0	9	44	10	55
Asia	**1,413**	**-882**	**454**	**124**	**193**	**252**	**520**	**263**	**624**
China	688	-658	0	5	0	0	34	0	0
Indonesia	39	0	39	-22	22	0	54	16	70
Japan	294	-243	3	0	0	0	77	0	7
Korea, Republic of	-1	0	0	-1	0	0	-2	0	0
Malaysia	115	90	205	0	19	18	156	91	247
Oceania	**-11**	**2**	**-2**	**-44**	**49**	**1**	**-50**	**49**	**3**
Australia	-9	2	0	-44	44	0	-48	44	3
New Zealand	-2	0	-2	0	1	1	-1	1	0
Europe	**5,131**	**-171**	**5,072**	**54**	**2,886**	**2,912**	**4,929**	**2,064**	**7,092**
EU-25	4,774	-319	4,561	10	2,489	2,487	4,895	1,387	6,392
Austria	921	0	925	207	129	337	1,207	34	1,246
Finland	13	0	14	14	18	33	79	10	92
France	595	0	611	274	203	478	660	50	730
Germany	1,953	0	1,988	-277	754	493	2,188	181	2,416
Italy	-11	0	0	-4	0	0	-15	0	0
Russian Federation	-427	427	0	-70	70	0	-427	427	0
Spain	362	-375	0	-111	126	0	-108	126	12
Sweden	-2	0	0	-1	0	0	0	0	3
United Kingdom	-10	0	0	-6	0	0	-15	0	0
Developed, all	-471	6,647	5,569	99	2,985	3,014	248	9,228	8,846
Developing, all	1,121	-563	516	5	309	280	455	488	870
World	649	6,084	6,084	105	3,294	3,294	703	9,716	9,716

Table 8. Predicted effects of changes in trade policies on fibreboard (x 1000 m³)

	Non-tariff			Tariff			Total		
	Prod'n	Import	Export	Prod'n	Import	Export	Prod'n	Import	Export
Africa	**-18**	**40**	**0**	**-22**	**50**	**3**	**-28**	**62**	**4**
Egypt	0	0	0	0	1	0	0	0	0
Nigeria	0	10	0	0	6	0	0	11	0
South Africa	-14	12	0	-16	17	0	-20	17	0
North/Central America	**-1,566**	**1,866**	**101**	**-26**	**291**	**247**	**-1,133**	**2,034**	**741**
Canada	94	0	101	196	27	240	431	0	461
Mexico	49	-25	0	-211	250	0	-181	229	1
United States	-1,708	1,882	0	0	0	6	-1,373	1,782	279
South America	**140**	**25**	**168**	**263**	**65**	**331**	**333**	**74**	**416**
Argentina	11	4	15	151	2	154	219	4	226
Brazil	33	0	38	10	24	39	9	24	40
Chile	109	2	114	113	3	118	116	4	123
Asia	**2,438**	**-1,159**	**514**	**377**	**417**	**626**	**1,551**	**144**	**737**
China	1,519	-757	0	126	0	0	905	0	0
Indonesia	82	0	84	88	53	144	136	37	177
Japan	242	-243	0	-30	50	3	264	-235	8
Korea, Republic of	132	-142	0	-17	9	0	-24	9	0
Malaysia	385	28	415	385	27	415	404	38	445
Oceania	**-7**	**0**	**-2**	**-24**	**29**	**4**	**-22**	**20**	**5**
Australia	-7	0	-2	-25	26	1	-22	19	2
New Zealand	-1	0	1	1	2	3	0	2	4
Europe	**-104**	**242**	**230**	**-315**	**1,427**	**1,066**	**328**	**1,113**	**1,543**
EU-25	-3	-39	35	-279	1,140	818	410	755	1,254
Austria	3	0	6	-25	32	8	-1	7	11
Finland	-3	1	0	-4	10	6	5	8	17
France	-19	0	-14	148	192	345	351	85	453
Germany	-4	0	8	-149	153	10	-32	25	11
Italy	-8	0	0	-3	0	0	-2	0	10
Russian Federation	-286	283	0	-153	154	0	-286	283	0
Spain	-10	0	-1	-312	324	2	-231	236	2
Sweden	-3	0	0	-1	0	0	-2	0	1
United Kingdom	-10	0	0	-5	0	0	-8	0	6
Developed, all	**-1,498**	**1,891**	**330**	**-188**	**1,557**	**1,321**	**-392**	**2,704**	**2,296**
Developing, all	**2,381**	**-878**	**682**	**441**	**722**	**958**	**1,421**	**742**	**1,150**
World	**883**	**1,013**	**1,012**	**253**	**2,279**	**2,278**	**1,029**	**3,447**	**3,446**

Table 9. Predicted effects of changes in trade policies on chemical pulp (× 1000 tonnes)

	Non-tariff			Tariff			Total		
	Prod'n	Import	Export	Prod'n	Import	Export	Prod'n	Import	Export
Africa	**-34**	**10**	**51**	**-59**	**4**	**51**	**-87**	**15**	**76**
Egypt	0	-6	0	0	-3	0	0	-3	0
Nigeria	-30	0	0	-6	0	0	-32	0	0
South Africa	-31	0	-19	-47	0	13	-79	0	-12
North/Central America	**686**	**629**	**52**	**348**	**1,100**	**-29**	**856**	**1,014**	**-38**
Canada	137	0	52	71	0	-29	149	0	-39
Mexico	15	0	0	-38	0	0	-36	0	0
United States	536	628	0	315	1,100	0	745	1,014	0
South America	**214**	**16**	**244**	**68**	**140**	**328**	**60**	**147**	**330**
Argentina	0	0	0	-25	25	0	-26	25	1
Brazil	127	0	131	-42	98	129	-41	98	132
Chile	113	0	113	160	3	198	162	3	198
Asia	**946**	**-760**	**52**	**-408**	**189**	**23**	**761**	**-647**	**59**
China	-224	35	0	-181	-1	0	-296	35	0
Indonesia	40	0	29	1	0	23	54	0	24
Japan	1,330	-877	23	99	0	0	1,369	-877	34
Korea, Republic of	-23	17	0	133	-110	0	206	-153	0
Malaysia	-84	63	0	-12	0	0	-91	62	0
Oceania	**-86**	**55**	**-3**	**-192**	**0**	**1**	**-214**	**3**	**-2**
Australia	-60	55	0	-194	0	0	-203	3	0
New Zealand	-25	0	-3	2	0	1	-10	0	-2
Europe	**-437**	**179**	**-269**	**1,360**	**-783**	**277**	**214**	**-126**	**-18**
EU-25	-609	177	-357	1,646	-923	240	355	-289	-117
Austria	-172	141	0	90	7	0	-196	259	0
Finland	-368	0	-140	170	0	8	-221	0	-187
France	-32	128	0	38	122	0	-31	250	0
Germany	366	-240	0	1,036	-722	0	1,070	-693	0
Italy	-76	184	0	146	-29	0	-72	182	0
Russian Federation	-21	0	0	-101	8	0	-100	8	0
Spain	-39	0	-50	286	0	162	224	0	98
Sweden	-190	0	-65	197	0	21	-47	0	-66
United Kingdom	10	0	0	32	0	0	30	1	0
Developed, all	**1,449**	**-15**	**-216**	**1,615**	**316**	**262**	**2,193**	**14**	**-37**
Developing, all	**-159**	**144**	**344**	**-498**	**333**	**388**	**-603**	**393**	**444**
World	**1,290**	**128**	**128**	**1,117**	**649**	**649**	**1,590**	**407**	**407**

Table 10. Predicted effects of changes in trade policies on printing and writing paper (× 1000 tonnes)

	Non-tariff			Tariff			Total		
	Prod'n	Import	Export	Prod'n	Import	Export	Prod'n	Import	Export
Africa	**-34**	**25**	**-22**	**-89**	**129**	**6**	**-95**	**133**	**-1**
Egypt	-20	19	0	-16	30	0	-16	30	0
Nigeria	0	0	0	0	0	0	0	0	0
South Africa	-22	0	-22	-62	70	6	-71	70	-1
North/Central America	**289**	**-24**	**281**	**203**	**156**	**340**	**492**	**145**	**632**
Canada	279	0	281	338	0	340	628	0	632
Mexico	38	-33	0	-117	153	0	-114	153	0
United States	-27	9	0	-17	0	0	-22	-10	0
South America	**3**	**0**	**1**	**-150**	**163**	**1**	**-150**	**163**	**1**
Argentina	0	0	0	0	0	0	-1	0	0
Brazil	-3	0	0	-68	76	0	-70	76	0
Chile	-1	0	0	-80	80	0	-79	79	0
Asia	**317**	**346**	**3**	**-44**	**541**	**113**	**266**	**755**	**151**
China	-192	780	0	-176	529	0	-275	1,030	0
Indonesia	-2	0	0	-3	0	0	-5	0	-1
Japan	606	-555	0	205	-206	0	645	-555	20
Korea, Republic of	-11	0	-8	45	0	48	64	0	70
Malaysia	11	0	0	3	0	0	12	0	0
Oceania	**-2**	**0**	**0**	**-414**	**421**	**0**	**-424**	**429**	**0**
Australia	-2	0	0	-416	422	0	-424	429	0
New Zealand	0	0	0	1	-1	0	0	-1	0
Europe	**54**	**32**	**117**	**957**	**846**	**1,795**	**818**	**863**	**1,704**
EU-25	-168	26	-114	870	651	1,525	535	668	1,235
Austria	-59	0	-59	217	0	217	152	0	152
Finland	-233	0	-233	366	0	367	103	0	104
France	-11	8	0	4	-7	0	-2	-3	0
Germany	319	0	324	791	0	796	951	0	960
Italy	-5	3	0	4	-6	0	-1	-3	0
Russian Federation	0	0	0	-1	1	0	-1	1	0
Spain	-38	36	0	15	-15	0	2	-4	0
Sweden	-110	0	-110	113	0	113	-3	0	-3
United Kingdom	5	-10	0	16	-20	0	17	-26	0
Developed, all	887	-513	376	1,004	1,133	2,141	1,572	798	2,356
Developing, all	-259	892	3	-540	1,123	114	-666	1,690	132
World	628	379	379	464	2,256	2,256	906	2,488	2,488

Table 11. Predicted effects of changes in trade policies on other paper and paperboard (× 1000 tonnes)

	Non-tariff			Tariff			Total		
	Prod'n	Import	Export	Prod'n	Import	Export	Prod'n	Import	Export
Africa	-134	150	-1	-148	172	0	-208	237	-1
Egypt	-1	0	0	6	1	0	6	1	0
Nigeria	-49	49	0	-9	9	0	-49	49	0
South Africa	-1	0	-1	-78	79	0	-81	79	-1
North/Central America	2,044	25	2,079	2,442	41	2,482	3,025	78	3,111
Canada	18	0	19	4	0	5	17	0	19
Mexico	9	-2	0	8	6	0	11	6	0
United States	2,044	0	2,060	2,462	0	2,476	3,066	0	3,091
South America	-38	40	1	-53	130	72	-62	146	80
Argentina	0	0	0	0	0	0	0	0	0
Brazil	-2	0	0	-37	36	0	-39	36	0
Chile	0	0	1	4	68	72	12	68	80
Asia	-2,226	2,572	33	-2,469	2,777	60	-2,866	3,645	360
China	-2,128	2,396	0	-2,167	2,396	0	-2,793	3,144	0
Indonesia	29	0	31	-46	54	12	73	54	132
Japan	319	-291	0	0	0	0	338	-291	8
Korea, Republic of	-2	0	1	-2	0	0	83	0	87
Malaysia	-251	259	0	-121	125	0	-328	338	0
Oceania	-17	0	-16	-62	66	4	-67	66	0
Australia	-7	0	-6	-65	66	1	-68	66	-1
New Zealand	-10	0	-10	3	0	3	1	0	1
Europe	674	-620	70	570	536	1,102	608	502	1,123
EU-25	602	-618	-4	998	-102	898	952	-135	832
Austria	13	0	14	31	0	31	54	0	55
Finland	-235	0	-235	70	0	71	-121	0	-120
France	338	0	339	516	0	518	729	0	732
Germany	-1	0	0	-2	0	0	-1	0	2
Italy	363	-365	0	364	-365	0	363	-366	0
Russian Federation	-40	0	-38	-174	202	27	-171	202	32
Spain	103	-105	0	361	-362	0	391	-392	0
Sweden	-117	0	-116	192	0	193	61	0	61
United Kingdom	3	-4	0	3	-4	0	2	-3	0
Developed, all	3,036	-910	2,133	2,925	652	3,588	3,915	323	4,241
Developing, all	-2,734	3,078	34	-2,646	3,069	132	-3,485	4,351	433
World	302	2,167	2,167	280	3,720	3,721	430	4,674	4,673

Table 12. Predicted effects of changes in trade policies on producer revenue, consumer expenditure, and value added (million $U.S.)

	Non-tariff			Tariff			Total		
	Prod'n	Import	Export	Prod'n	Import	Export	Prod'n	Import	Export
Africa	**-342**	**-537**	**-116**	**-655**	**-830**	**-132**	**-594**	**-956**	**-188**
Egypt	-7	2	-7	-80	-177	-2	-80	-173	-2
Nigeria	-85	-51	-25	-19	-16	-4	-92	-59	-25
South Africa	35	28	-34	-217	-116	-68	-76	-23	-94
North/Central America	**-3,021**	**-3,156**	**-2,202**	**1,972**	**652**	**1,200**	**-864**	**-2,297**	**-1,130**
Canada	861	332	660	876	372	389	2,210	875	1,205
Mexico	-672	-525	-94	-1,220	-925	-228	-1,425	-1,095	-264
United States	-3,188	-2,951	-2,756	2,374	1,282	1,066	-1,552	-1,984	-2,025
South America	**549**	**195**	**71**	**334**	**100**	**57**	**758**	**265**	**111**
Argentina	9	4	2	37	13	16	119	49	43
Brazil	379	192	39	277	138	30	400	201	16
Chile	267	113	47	129	48	26	351	146	66
Asia	**-10,226**	**-11,817**	**1,315**	**-6,956**	**-6,444**	**-1,436**	**-14,511**	**-16,197**	**400**
China	-10,827	-10,065	-703	-6,711	-5,443	-1,409	-13,565	-12,256	-1,298
Indonesia	456	180	171	720	283	252	974	384	362
Japan	220	-1,763	1,918	-83	-376	-75	-958	-3,308	1,615
Korea, Republic of	121	103	30	135	110	34	297	214	100
Malaysia	56	-50	17	254	47	106	191	-16	58
Oceania	**243**	**104**	**-96**	**-538**	**-271**	**-322**	**-170**	**-116**	**-377**
Australia	166	85	-35	-540	-232	-325	-311	-123	-337
New Zealand	50	18	-60	7	3	4	114	47	-38
Europe	**4,445**	**2,108**	**1,054**	**2,790**	**920**	**1,561**	**6,162**	**2,746**	**1,776**
Austria	289	127	102	333	148	153	614	261	265
Finland	-159	-82	-410	600	269	246	474	210	-128
France	518	269	178	597	240	376	1,060	502	454
Germany	1,451	558	659	1,298	467	664	2,548	948	1,210
Italy	295	182	144	732	297	453	380	256	168
Russian Federation	130	54	-106	-160	-66	-79	69	24	-118
Spain	262	147	49	-222	-133	-14	-86	-37	-18
Sweden	151	24	-194	572	284	176	641	264	-40
United Kingdom	180	150	51	240	125	116	317	228	105
World	**-7,996**	**-12,964**	**-160**	**-3,305**	**-6,201**	**826**	**-8,850**	**-16,636**	**444**

6.1 Impacts on production

In general, removal of NTBs leads to an increase in world production and consumption of all wood products. This is not unexpected and is consistent with Zhu et al. (2001), who used the GFPM to look at the impacts of accelerated tariff reductions. The removal of NTBs and tariffs in effect lowers the cost of transporting products between countries, which in turn induces greater consumption and production. What is surprising is that the impacts are relatively minor in terms of absolute and percentage changes in volumes traded, even when all policy distortions are removed. The percentage change (not shown) in world production (consumption) is less than 1% for all products, except for wood-based panels (2.2%) and fibreboard (1.4%). Similar results hold for the removal of tariffs, although impacts on production are even less in all cases. In terms of the volume of production, the largest impacts in production occur with industrial roundwood and wood-based panels.

The results differ at the regional level. Absolute and percentage impacts are generally larger at the regional level for both NTBs and tariffs, with some regions experiencing large impacts and others experiencing negligible impacts. NTB impacts versus tariff impacts vary more at the regional level. For example, in the case of sawnwood, particleboard, and chemical pulp, the impacts of NTBs are the opposite of those of tariff barriers across several regions. Upon comparing developed and developing countries, developed countries generally increase production of primary wood products and pulp and paper products, whereas developing countries increase production of value-added wood products (panel products).

The removal of either NTBs or tariffs increases production of all the forest products in Canada, with one exception: industrial roundwood. The removal of its NTBs leads to a slight reduction in industrial roundwood production and an increase of its imports in Canada. This probably happens mostly in eastern Canada after removing the NTBs on importing industrial roundwood. On the other hand, the largest increase in production (more than 1 million m^3) occurs with the removal of tariffs on industrial roundwood. As almost no change in exports and imports associated with removal of tariffs on industrial roundwood occurred, the significant rise in production is due mainly to an increase in domestic consumption that results from production increases in the sawnwood, panel products, and pulp and paper products. Generally, the production increases associated with the removal of NTBs are larger than those associated with the removal of tariffs, except in the cases of fibreboard and printing and writing paper.

6.2 Impacts on trade

The impacts of NTBs on trade are generally larger than their impacts on production, in absolute and percentage terms, at the world and regional levels. This is similar to findings by Zhu et al. (2001) and Liu et al. (2005), who used a different trade model and studied only the benefits of tariff reductions. The exceptions are chemical pulp and printing and writing papers. Comparison of impacts of NTBs versus impacts of tariffs is not straightforward. The impact of NTBs on trade volumes is larger than that of tariffs on some products like industrial roundwood and sawnwood, but tariff impacts are greater on fibreboard and pulp and paper products.

The impacts of NTBs on industrial roundwood trade are very significant across all regions, often stimulating an increase in both imports and exports. In terms of volume, the largest impact is the increase in imports in Asia and an increase in exports from North and Central America and from Europe. The impacts of tariffs on trade are minor relative to the impacts of NTBs.

The impacts of NTBs and tariffs on sawnwood are similar in magnitude, but often different in direction within regions (e.g., Europe and South America).

Europe is an interesting case in this regard. A removal of NTBs increases imports to Europe and decreases exports. A removal of tariffs leads to the opposite effects. A removal of both, on the other hand, leads to an almost equal increase in both imports and exports, leaving net trade unchanged but substantially increasing trade volumes. This

curious result stems from the fact that different sets of countries tend to impose NTBs and tariffs. This case suggests that a meaningful assessment of the impacts of NTBs also needs to consider existing tariffs, as done here, to capture the non-uniform application of trade protection across countries and forest products. Similar differences in impacts between NTB and tariffs for other regions and products are apparent in Tables 3 through 10.

Removal of tariffs or NTBs leads to increased specialization by developed countries in the production and exportation of industrial roundwood, sawnwood, and paper products, whereas developing countries move to greater specialization in wood-based products and fibreboard.

Focusing on Canadian results, removal of either type of trade restriction generally serves to increase the net exports of Canadian forest products. The increases in net exports associated with the removal of NTBs are 0.67 million m^3 of sawnwood, 0.08 million m^3 of wood-based panel board, 0.36 million m^3 of particleboard, 0.1 million m^3 of fibreboard, 0.05 million tonnes of chemical pulp, 0.28 million tonnes of printing and writing paper, and 0.02 million tonnes of paper and paperboard. However, removal of NTBs on industrial roundwood results in a net import of 2.8 million m^3 of roundwood into Canada. As mentioned before, we expect this mainly applies to eastern Canada. The impacts of the removal of tariffs on trade are slightly less than those of NTBs in most of cases.

6.3 Impacts on producer revenues, consumer expenditure and value added

Producer revenues and consumer expenditures are affected similarly by current NTBs and tariffs, although the measured impacts are twice as large for NTBs. In both cases, and from a world perspective, producers have higher revenues and consumers face higher expenditures for forest products as a result of non-tariff and tariff barriers, because both producers and consumers experience higher prices. The removal of either trade barrier reduces prices, and thus affects producer revenues and consumer expenditures, despite higher production and consumption. The decline in consumer expenditures is greater than the drop in producer revenues, so consumers gain more than producers lose and, as a result, global welfare increases with the removal of NTB and/or tariffs.

Once again, the non-uniform and inconsistent use of non-tariff and tariff barriers among countries and products results in very different impacts across scenarios. Considering only a removal of NTBs, Africa, North and Central America, and Asia experience larger consumer gains than producer losses, whereas producers gain more than consumers lose in South America, Oceania, and Europe. Removal of tariffs leads to a net gain for producers in North America and no net gain in Asia or Oceania. In the other regions, the impacts are similar to the removal of NTBs, with net consumer gains for Africa and net producer gains for South America and Europe. The differing fortunes of consumers and producers in various regions under different scenarios underscores the need for trade analysis to look at all forms of trade policy and not focus on only tariffs or NTBs.

Similar results and insights are also generated by focusing on changes in value added. Globally, the changes are small, but substantial changes occur at the regional level and some of these differ significantly among scenarios.

The impacts of NTBs and tariffs are mixed at the country level. The majority of the countries modelled experience net gains from removing trade barriers. Among the 25 major countries listed, 16 experience net producer gains (Canada, Argentina, Brazil, Chile, Indonesia, Korea, Malaysia, New Zealand, Austria, Finland, France, Germany, Italy, Russia, Sweden, and the UK), 3 experience net consumer gains (Egypt, the U.S., and Japan), and 6 (Nigeria, South Africa, Mexico, China, Australia, and Spain) experience minor net losses. The countries that benefit the most from global free trade of forest products are Japan, Germany, and Canada, which experience net gains of $US 2.4 billion, $US 1.6 billion, and $US 1.3 billion, respectively. Net producer gains for Canada from removing NTBs and from removing tariffs are similar: $US 0.53 billion and $US 0.50 billion, respectively.

The impacts on value added for each country from the two scenarios are also mixed. Japan, Canada, and Germany achieve the most gains in value added by removing the NTBs, whereas the U.S. and China experience significant losses. In the scenario of removing tariffs, the U.S. and Germany achieve the most gains in value added, but significant losses occur in China. Canada's value added rises by $US 1.2 billion when both trade barriers are removed ($US 0.67 billion due to the removal of NTBs).

7. Summary and conclusions

There is increased interest in understanding the impacts of NTBs on the forest products industry. As trade liberalization efforts have effectively reduced tariffs during the past decades, NTBs have come under greater scrutiny. Although increased trade does not necessarily translate into increased welfare, particularly if trade policies attempt to correct market failures, a reduction in the impediments to trade generally enhances global welfare. In this report, we address questions relating to the impacts of non-tariff trade barriers on the global forest sector, with results supporting concerns that NTBs negatively affect forest products trade and production. However, in light of the concurrent impacts of existing tariffs imposed by different countries on different products, the results do not necessarily support the notion that trade negotiations should focus primarily on NTBs. On the contrary, efforts should continue to focus on reducing all inappropriate forms of trade protection, tariff or non-tariff.

The impacts are generally larger at the regional and country levels for both NTBs and tariffs. The majority of the countries included in the analysis benefit from global free trade of forest products. More countries experience net producer gains than net consumer gains. However, globally, the consumers gain more than producers lose.

Future research is needed to address several shortcomings in this study. The tariff rates include only most-favoured nation rates and do not include bilateral tariffs (such as those under the Canada–U.S. Softwood Lumber Agreement). Not all forms of NTBs are captured, and a more comprehensive analysis is needed to account for excluded NTBs.

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Canadian Forest Service Contacts

1 Atlantic Forestry Centre
P.O. Box 4000
Fredericton, NB E3B 5P7
Tel.: (506) 452-3500 Fax: (506) 452-3525
cfs.nrcan.gc.ca/regions/afc

Atlantic Forestry Centre – District Office
Sir Wilfred Grenfell College Forestry Centre
University Drive
Corner Brook, NF A2H 6P9
Tel.: (709) 637-4900 Fax: (709) 637-4910

2 Laurentian Forestry Centre
1055 rue du P.E.P.S., P.O. Box 3800
Sainte-Foy, PQ G1V 4C7
Tel.: (418) 648-5788 Fax: (418) 648-5849
cfs.nrcan.gc.ca/regions/lfc

3 Great Lakes Forestry Centre
P.O. Box 490, 1219 Queen St. East
Sault Ste. Marie, ON P6A 5M7
Tel.: (705) 949-9461 Fax: (705) 759-5700
cfs.nrcan.gc.ca/regions/glfc

4 Northern Forestry Centre
5320-122nd Street
Edmonton, AB T6H 3S5
Tel.: (403) 435-7210 Fax: (403) 435-7359
cfs.nrcan.gc.ca/regions/nofc

5 Pacific Forestry Centre
506 West Burnside Road
Victoria, BC V8Z 1M5
Tel.: (250) 363-0600 Fax: (250) 363-0775
cfs.nrcan.gc.ca/regions/pfc

6 Headquarters
580 Booth St., 8th Fl.
Ottawa, ON K1A 0E4
Tel.: (613) 947-7341 Fax: (613) 947-7396
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